REMARKS

Minor modifications have been made in the specification, claims 1-15 have been amended, claim 16 has been cancelled, and new claim 17 has been added. Claims 1-15 and 17 remain in the application

The specification has been amended to introduce appropriate section headings, change the reference of WO 94/15113 to U.S. 5,449,152, and change the reference of FR 2 672 947 to U.S. 5,205,029.

This is because WO 94/15113, corresponding to US-5,449,152, is the closest prior art considered in the specification as being the starting point of this invention, as explained from page 4 line 32 to page 5 line 10 of the specification and the object of the present invention is precisely, as mentioned also in page 4 lines 23 to 31 to propose a device of the type known from WO 94/15113 but having a structure which makes it possible to precompress each tubular elastomeric sleeve at the time of manufacture so as to remedy the drawbacks of devices known from WO 94/15113, and particularly to obtain a device with elastomeric sleeves offering much better fatigue resistance and a longer service life, with the further possibility to have each annular end face of each elastomeric sleeve shaped as a meniscus.

Similarly, in the specification, FR 2 672 947 has been changed to US-5,205,029 in page 1 lines 28 and 35 and in page 2 line 9, since FR 2 672 947, cited in the specification as illustrating the prior art, corresponds to the De Antonio et al. patent.

Claims 1-16 were rejected under 35 U.S.C. 112, second paragraph, as being indefinite.

Claim 1 as originally drafted was directed to a device for the damped elastic connection of two parts, the device comprising at least one set of at least two tubular cylindrical sleeves of

viscoelastic material, and not just one set of two tubular cylindrical sleeves of viscoelastic material as represented in the drawings and described with reference thereto.

This is clearly explained in the specification in page 12 lines 6-11 and 29-31, explaining that the device may comprise several sets (such as 6 or 6' in figures 1 and 2) spaced apart axially between an internal armature and an external armature, the or each of several axially spaced apart sets comprising at least two, but possibly more than two elastomer sleeves separated by cylindrical rigid rings.

The fact that each said set could have more than two sleeves of viscoelastic material led to the complicated wording of claim 1 as originally filed which is questioned in page 3 of the Office Action.

As explained in the specification page 12 lines 12-28, if a set comprises three elastomer sleeves, these sleeves define two pairs of contiguous sleeves (one pair comprising the inner sleeve and the intermediate sleeve, the other pair the intermediate sleeve and the external sleeve), and the sleeves are separated by two intermediate rigid rings, with of course an internal rigid ring and an external rigid ring, which means altogether three sleeves and four rigid rings. In such an embodiment, according to the invention, the relation given in claim 1 needs to be satisfied for each pair of two contiguous elastomer sleeves, with the internal ring of the innermost pair of sleeves being the innermost ring, and the external ring of the outermost pair of sleeves being the outermost ring.

More generally, with n elastomer sleeves, constituting n-1 pairs of two contiguous sleeves, where $n \geq 4$, there is an intermediate pair of sleeves separated by an intermediate ring and between two other intermediate rings, one of which is the internal ring of this pair of sleeves

without being the innermost ring, and the other of which is the external ring of this pair of sleeves without out being the outermost ring. And there is also an innermost pair of sleeves with an internal ring which is the innermost ring of the set, and an outermost pair of sleeves with an external ring which is the outermost ring of the set.

Therefore, and in reply to the questions raised by the Examiner with respect to claim 1 in page 3 of this Office Action, there is not a single reply, and depending on the number of sleeves, for some pair of sleeves the innermost ring or the outermost ring is the same as the internal rigid ring or the external rigid ring, whereas for some other pair of sleeves, these elements are not the same.

But, due to difficulties in industrializing sets with more than two elastomeric sleeves, due to their great complexity, and therefore much more higher cost, the Applicant has decided to limit the scope of claim 1 to the embodiments of the device having at least one set of (only) two tubular cylindrical sleeves of viscoelastic material. This greatly simplifies the wording of claim 1, which has been amended in this respect, and simultaneously so as to remedy the other deficiencies noted in page 3 of the Office Action, as far as claim 1 is concerned.

But the scope of the amended claim 1 still extends to devices comprising at least one set of two tubular cylindrical sleeves, to encompass the embodiments as mentioned in page 12 of the specification lines 8 and 9, with several sets, generally two sets, spaced apart axially between an internal armature and an external armature, as is known, for example, in figure 2 of the De Antonio et al. patent US-5,205,029, corresponding to FR 2 672 947 cited in the specification as document illustrating the prior art (i.e. with only one elastomeric sleeve in each set).

In the attached amendments to the claims, claims 2-14 have also been amended in a way consistent with the amendments introduced into claim 1, and a new claim 17 has been introduced, for covering the alternative embodiment which was in claim 10 as originally filed (last feature of claim 10).

In addition, also amended is the first method claim 15, for manufacturing a device for damped elastic connection according to claim 1, all features of amended claim 1 been now introduced into amended claim 15 instead of the terms "according to claim 1" which have been suppressed.

Finally, claim 16, relating to the second method of manufacture, has been cancelled, in view of the Examiner's objections at the bottom of page 2 and in page 4 of the Office Action.

Concerning the claim rejections based on 35 U.S.C. § 102, Applicant does not at all agree that Byrnes et al. (US-5,449,152) discloses all the limitations of amended claim 1.

As noted above, Byrnes et al. corresponds to the PCT application WO 94/15113, which is cited in the specification and presented therein as the closest prior art, and a fair presentation of it has been given from page 3 line 14 to page 4 line 12.

It is agreed that Byrnes et al. and the instant application globally have the same goals, but the means implemented to reach the looked-at results is different :

Byrnes et al. teaches a so-called "continuous" or "progressive" solution, which aims at making uniform the stiffness of each elemental layer of the elastomeric sleeve.

This is clearly explained in Byrnes et al. with respect to figure 5, in which, contrary to the Examiner's statement, there is no intermediate rigid ring separating an internal sleeve from

column 3 lines 48-50

mention

an external sleeve, because in figure 5 there is only one elastomeric sleeve made out of three tubular layers, between an external rigid ring 13 and a central shaft 12 (analogous to an internal rigid ring).

Theoretically, this choice of Byrnes et al. is expressed by the following relation: $r_i \cdot L_i = r_{i+1} \cdot L_{i+1}$, where r_i and r_{i+1} are the inner diameters of respectively the i layer and i+1 layer, and L_i and L_{i+1} are respectively the axial lengths of the i layer and i+1 layer.

This is fairly expressed in the specification in page 3 lines 15-22, where one teaching of Byrnes et al. is presented as being to modify the profile of the cross section of the elastomer sleeve in axial section, giving the various elemental layers of this elastomer sleeve an axial length that is inversely proportional to their radius, or, alternatively, an axial length and a radius which are such that their product is constant, so as to have elemental layers of the elastomer sleeve which have the same surface area, and therefore the same stiffness, so as to obtain uniform stressing throughout the elastomer sleeve.

This is disclosed in Byrnes et al. not only in the abstract, but also in column 3 lines 41-68, the one or more cylindrical shims which might be included optionally between the plys of the sleeve to increase axial stiffness not altering the above relation between the radius and length of each elemental layer.

In contrast with this teaching, the present invention proposes a "stepwise" or discontinuous solution, comprising several (now two) separate sleeves of which the global stiffnesses are identical.

Theoretically, the choice made in the instant invention corresponds to the relation mentioned in claim 1 i.e

$$g1 \cdot \frac{L1}{\ln(1+\frac{e1}{R1})} = g2 \cdot \frac{L2}{\ln(1+\frac{e2}{R2})}$$

with g1 and g2 being respectively the shear modulus of the viscoelastic material for one and for the other sleeve, L1 and L2 being the axial lengths of these two sleeves, R1 and R2 being their respective inside radius and e1 and e2 being their respective thickness, as explained in page 5 of the specification lines 11-18 and again from page 8 line 27 to page 9 line 4.

The novelty of claim 1 of the instant application does obviously not reside in the stiffness equation, which has been known for a very long time, but in building a damping device with several stages of same global stiffness, without imposing that each elementary layer has the same stiffness.

In Byrnes et al., the bevelled shape imposed, for each elemental layer of elastomer, by the above-mentioned relation ($r_i \cdot L_i = r_{i+1} \cdot L_{i+1}$), which needs be satisfied, is not compatible with the introduction of a meniscus shape at each annular axial end of the sleeves, and the utility of which cannot be challenged as far as the reduction of the local over stresses is concerned, and therefore the increase of service life. In addition, the fact that the elastomer is not locally confined in the end zone opposes the positive effects expected from the bevelled shape.

This is also mentioned in the specification in page 3 lines 23-30.

A first conclusion is that the means proposed by Byrnes et al. may look theoretically pure, but, in practice, it does not make it possible to obtain the expected advantages.

The present invention, although theoretically less attractive, since all elemental layers do not have the same stiffness, makes it possible to obtain the looked-at results, in taking a better profit from the practical experience of the inventor, following a more pragmatic approach.

Byrnes et al. also gives an alternative teaching in connection with an alternative embodiment (figures 7 and 7a) and according to which it is proposed to laminate the elastomer sleeve into various tubular layers with different mechanical properties and which are coaxially fitted one inside the other. In such an embodiment, meniscus shaped annular axial ends can be obtained, but not at the axial ends of a sleeve made out of a same elastomeric material, having its particular shear modulus g. On the contrary, the different layers (three layers in figure 7) of the elastomeric sleeve are composed of materials having different damping and fatigue strength properties, and therefore different modulus of elasticity, which means that the different layers have different stiffnesses, what is again contrary to what is claimed in amended claim 1.

But in this alternative embodiment of Byrnes et al., due to the different surface areas involved, uniform strength is substantially obtained from the inner to the outer bounding interfaces.

This alternative embodiment is discussed in the specification from page 3 line 31 to page 4 line 2. It has two inherent drawbacks, one being that there is no possibility of independently stressing in compression each of the various layers of the elastomer sleeve, which seriously prejudices their fatigue performance, and the second drawback being that the different layers have a stiffness that increases from the internal layer to the external layer, contrary to what is obtained with a device according to amended claim 1.

According to a further teaching of Byrnes et al., it is proposed that continuous layers of elastomer of the sleeve be separated radially from one another by a rigid metallic shims or rings, making it easier for the heat produced in the stressed elastomer to be removed and to increase the axial rigidity. But, in such embodiment, axial recesses are formed in the contiguous layers of

elastomer and these recesses have a cross section which increases with the radius so that the area of each elemental layer of elastomer is substantially constant from the internal armature to the external armature, in the circumferential direction and as described with reference to figures 6 and 9 of Byrnes et al.

This is also mentioned in the specification in page 4 lines 3-12, and is not what is claimed in amended claim 1, so that is appears that Byrnes et al. never discloses nor renders obvious the specific features of amended claim 1, which are the specific geometry of the two elastomeric sleeves, as defined by axial length L, inside radius R and thickness e, in combination with a specific shear modulus g, so that the formula given in amended claim 1 is satisfied.

Therefore, the Applicant is of the opinion that amended claim 1 is not only new but also non-obvious over Byrnes et al.

As to the dependent claims, it is admitted that claims 2-7 and 10-13 have specific features which are known in themselves from several prior art documents, including the secondary references cited by the Examiner.

The patentability of these dependent claims is to be found in their combination with amended claim 1, and it appears also that amended claims 8, 9, 14 and 15 have specific features which do not appear to be known from the secondary references.

Therefore, the amended claims 1-15 and new claims 17 should be held allowable.

Respectfully submitted,

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8-19-03
Date

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